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MONTANA ENERGY CONSERVATION PLAN

Working Paper No. 6

GOVERNMENT ENERGY CONSERVATION

A Report to the

Montana Energy Advisory Council

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Prepared for

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6.0 GOVERNMENTAL SECTOR

6.1 Solid Waste

Montana disposed of about 600,000 tons of solid waste last year. The energy associated with this waste is not simply that of disposal. The energy used to produce the items, to extract the necessary raw materials, and to control the pollution resulting from production, extraction, and transportation must also be considered. Not all of this energy must be lost.

Bottles and cans can be reused or recycled; organics and paper can be used as fertilizer or fuel. Landfilling these items is throwing away energy. This section investigates the utilization of this wasted energy. A proposed mechanical resource recovery project is analyzed for its applicability to Montana's waste system. A source-separation option is developed for urban and rural communities. Finally, waste reduction options which would reduce overall energy consumption are investigated.

6.1.1 Current Montana Practices

In 1975, Montana produced 590,000 tons of solid waste (see Table 6.1.0). The most common disposal practice was landfill. As of December 1975, only 38% of Montana's communities were operating approved disposal sites. These sites, however, served 76% of the state's population. Of the remaining communities which operate unapproved sites, 82% had populations of less than 1,000. This does not take into account rural wastes which are commonly disposed of on the producer's own property (Henningson, 1976).

When solid waste is landfilled, the energy which could have been extracted from garbage and yard waste is lost--as is the glass metal and paper which could have been reprocessed and used again. By throwing away these items,

we are increasing our need for extraction and transportation of raw materials--as well as the energy used in processing new items.

6.1.2 The Four R's: Reduce, Reuse, Recycle, Recover

As seen in Table 6.1.1, a total energy equivalent of 6.74×10^{12} Btu's was discarded in Montana in 1975. Various options are available to reduce and/or recover this amount.

6.1.2.1 Reduce the amount of materials which must be disposed

Of all discarded waste in the U. S., 35% is packaging and 10% is major appliances and tires (League of Women Voters, 1976). More durable products and reduction in packaging by manufactures would save the energy of the original production and that needed for disposal.

6.1.2.2 Reuse of items for their original purpose

For example, a returnable bottle which is used ten times can cut production energy and raw materials use by one-half and post-consumer solid waste by one-fifth (EPA SW-161-1975).

6.1.2.3 Recycle materials for reprocessing

Making products from recycled materials decreases the energy used for processing (see Table 6.1.2).

6.1.2.4 Recover energy

Food and yard waste presently being landfilled has an energy value of $1.77\ 10^{12}$ Btu's. This energy can be converted to useable forms by a variety of methods.

Table 6.1.0
Montana's Solid Waste for 1975

Type	of processible	tons
Processible:		
paper	38.2	175,796
plastic	5.8	26,692
glass	8.7	40,037
ferrous metals	9.1	41,878
non-ferrous metals	1.5	6,903
food	19.3	88,818
yard	11.7	53,843
other	5.7	26,231
	100	
Nonprocessible:		
sewage sludge, demolition waste		129,800
	Total:	590,000

Table 6.1.1
Energy Equivalents of Resources
Disposed in Montana (1975)

Resource Type	Tons	Energy to Produce (BTU's)	Heat Content (BTU)
paper	175,796	1.16×10^{12}	
plastic	26,692	1.2×10^{9}	
glass	40,037	$.31 \times 10^{12}$	
ferrous metal	41,878	1.95×10^{12}	
non-ferrous metal	6,903	1.55×10^{12}	
food	88,818		1.1×10^{12}
yard	53,843		$.67 \times 10^{12}$
other	26,237		12.5×10^{6}
		4.97×10^{12}	1.77×10^{12}

Source: Hennington, 1976; Beny, 1974

6.1.3 Benefits of Materials Recycling

Solid waste collection and disposal is often the largest single expense of a city. Recent federal legislation on air and water pollution has eliminated open burning as a disposal alternative and has made landfill requirements more stringent. Adequate landfill sites are becoming increasingly difficult to acquire near urban areas. The recovery from solid waste of such items as glass, metal and paper has a positive impact on this problem by reducing the volume to be disposed.

In addition to helping these local problems, recycling is beneficial in a larger sense: It decreases the amount of raw materials needed. This is especially significant since the U. S. consumption of raw materials has increased 20-40% per decade in the 20th century. By decreasing the consumption of raw materials, the environmental damage associated with acquiring these raw materials is reduced along with the amount of process chemicals and fuels needed for mining, processing, and transportation.

The reprocessing of recoverable materials uses less energy than the processing of raw materials (see Table 6.1.2) and reduces the level of air and water pollution associated with processing.

6.1.4 Two Methods of Recycling Materials

The first method is "source separation," in which consumers do not mix glass, metals, and paper with other wastes. The second method is called "resource recovery." In this process, mixed wastes are transported to a central location where they are mechanically separated.

Table 6.1.2
Production Energy Saved by Recycling

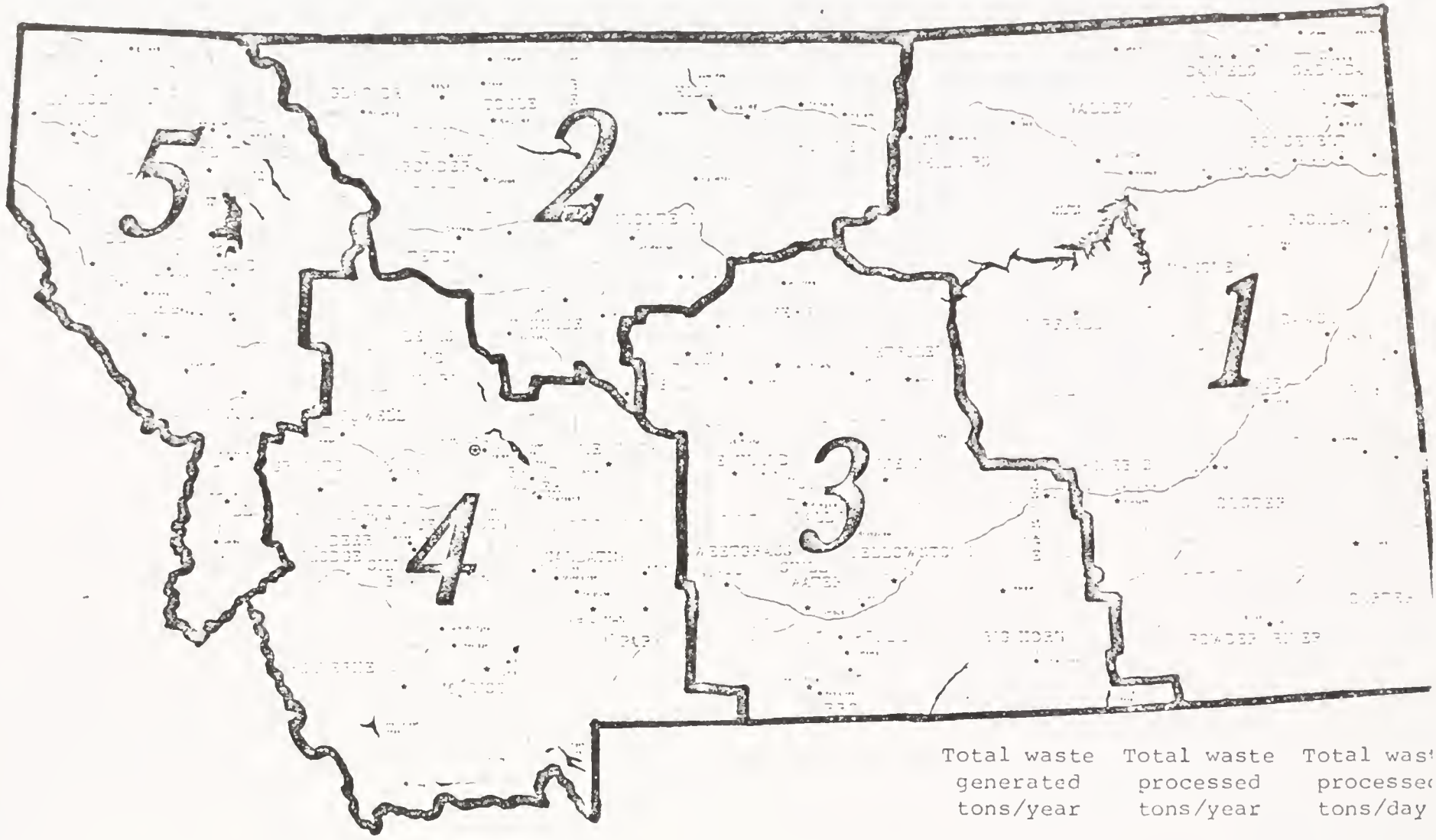
	Energy to Produce from Raw Material 10^6BTU/ton	Energy to reprocess materials 10^6BTU/ton	% energy savings
steel	467	22.6	52%
oil	224.5	8.2	96%
plastic	45.2	2.0	96%
paperboard	6.6	3.3	50%
glass	5.8	7.8	0

6.1.5 Energy Recovery System (ERS)

Henningson, Durham and Richardson (1976) were contracted by the state of Montana to determine the possibilities of utilizing the combustible fraction of the state's waste as an energy source and of recovering secondary materials. The proposed Energy Recovery System (ERS) required 125-400 tons per day to operate effectively. Montana has a low population density (approximately four persons per sq. mi., 44th in the U. S.) and a low waste generation rate (4.28 pounds per person per day, 15% below the national average). The quantities of wastes needed for the proposed ERS can only be provided on a regional scale. Montana's five planning districts and their respective waste generation are shown in Figure 6.1.

6.1.5.1 Feasibility of processing wastes on a regional scale

To assess the feasibility of processing the wastes on a regional scale, the costs of collection and transportation and the cost of processing must be considered. Nationally, the collection costs are about 60-80% of a city's solid waste expenses (EPA 500-1976). These collection costs would remain unchanged with the proposed ERS. In order to transport the waste to a regional processing plant, transfer stations were investigated. These stations would reduce the total cost of transportation from individual communities by consolidating refuse from several individual loads into one large load. This large load could then be transported in a larger, more efficient vehicle. However, as Table 6.1.4 shows the capital and operating costs of these stations are high. To take advantage



		Total waste generated tons/year	Total waste processed tons/year	Total wast processe tons/day
REGION	1	56,481	45,977	172
	2	117,601	91,224	350
	3	111,161	86,236	330
	4	138,197	106,963	411
	5	109,474	86,916	334

Table 6.1.4

Transfer Station Cost Summary

Facility size (tons/week)	10	30	50	100	150	250	500	750	1500	2000
Estimated population served	1,000	2,400	4,000	6,000	7,500	12,500	25,000	37,500	75,000	100,(
Facility Type ∞	Simple Composted					Single Push Pit			Double Push Pit	
Capital Costs	$68,100	$68,100	$88,800	$106,000	$106,000	207,500	241,000	241,000	412,100	$412,
Total Annual Cost	$9,400	$9,800	$12,900	$19,300	$26,000	$49,900	$77,700	$83,700	$129,000	$143,
Cost per ton	$18.80	$6.53	$5.16	$3.86	$2.48	$3.99	$3.11	$2.24	$1.72	$143

Source: Henningson,1976

of the decreasing cost per ton of waste processed, wastes must be transported from greater distances. These transportation costs are not figured into the cost of the transfer stations in this table.

6.1.5.2 Resource Recovery

Henningston, et. al. studied three types of mechanical resources recovery systems which operate in conjunction with energy recovery systems. The primary intent of the resource recovery system is to prepare the waste as a fuel stock for the ERS. Since the energy equivalent of the recyclable materials is more than twice that of the heat content of the combustible fraction, a significant energy loss would still be incurred by landfilling the noncombustible fraction.

The three types of resource recovery system studied by Henningson et. al. includes the following:

6.1.5.2.1 Preliminary Processing Mode

This option provides for the shredding of incoming waste and magnetic separation of ferrous metals. Once shredded, the reduced volume requires less landfill space, or it can be used as a feed stock for pyrolysis. However, all glass, paper, and aluminum remain in the waste.

Table 6.1.5

Preliminary Processing Mode Costs

Alternative Cost	Capital Cost	Unit cost/ ton @ 400 tpd	Unit cost/ ton @ 125 tpd
LANDFILL	$1,794,000	4.71	10.19
PROLYSIS FEED STOCK	$2,171,000	5.32	11.54

(The costs do not include collection, transfer or landfilling.)

The capital cost for this option is twice that of the previous one, and the cost per ton is considerably higher. The report stated that the increased revenue from the nonferrous metal separation would partially offset the higher unit processing costs. It should be noted that the income which would result from 100% recovery of aluminum in the largest waste disposal region is $276,000. At present, aluminum recovery systems are untested, and none could apprach 100% recovery.

In Montana, a large mechanical recovery system would entail a substantial capital outlay for the processing facility, transfer station, and collection vehicles. There are still the expenses of landfilling the non-combustible fraction. Operating costs should be considered and total system costs compared. In Montana's case, to consider only the construction and operating costs of an ERS could be quite misleading. Sale of secondary materials cannot be depended upon to offset expenses. Problems still exist with marketing materials recovered from mixed wastes.

> Scrap used in basic oxygen furnaces (when iron is refined to steel) should be visibly free of plastics and contain less than 1% dirt and no more than 3-5% organics. /The organics/ also constitute an additional load on the air pollution equipment. (EPA SW-161-1975)

Once the cans are mixed with other wastes, it is more difficult to guarantee the low levels of contamination.

The third proposed system hopes to recover aluminum also. This is attractive in that aluminum has a market value of $200-340 per ton in Montana (Henningston, 1976). However, all of the technologies for aluminum recovery remain unproven at present. Even if the technologies were proven, the question remains whether aluminum can be separated out at high enough yields to justify the additional processing (EPA SW-161-1975).

Glass recovery was not considered in the study. Even though there were available markets, the recovery technology is unproven and the purity required is difficult to achieve when recovering glass from mixed wastes.

6.1.5.3 Additional Considerations with regard to Energy Recovery Systems

Numerous large cities across the country have built resource and energy recovery systems. At present, six are being funded by EPA. However, no resource recovery system has been operated successfully to date.

> Mechanical separation, combustion and air pollution control equipment have failed to work in plants in St. Louis, Baltimore, and Nashville. The results have been high costs, delays and the need for even more sophisticated technology which planners hope will correct the problems. In Nashville the Thermal Transfer Corp. announced that unless $6,000,000 more was forthcoming, bondholders of the original $16 million invested would lose out. (Seldman, 1976)

Financing such systems has generally been difficult. Since resource recovery is such a new field, companies often have an idea but no experience

and no assets. In addition, there is a great deal of uncertainty about long-term operating costs, composition of the waste stream, and the value and marketability of recovered energy and materials. This does not look good to bankers and investors. As a result, there is an increasing reliance on public financing (general obligation bonds and revenue bonds) (EPA SW-8-1975). This means that if the system is not successful, the city will still be obligated to pay at least the interest on the bonds and possibly to increase utility rates. Another risk is that such systems require a long term commitment to a technology which can become outdated, economically uncompetitive, and environmentally unacceptable long before the capital costs are amortized.

High technology systems also lack flexibility to adapt to an altered waste stream. If wastes are reduced due to local recycling, changes in packaging, or population changes, the plant will operate less efficiently, and the cost per ton will increase. To protect themselves from increased operating costs and the loss of revenue from recovered materials, some private corporations have required contracts with cities guaranteeing delivery quotas. In Hempsted, Long Island, 6,000 tons per week are guaranteed by the city. In New Orleans, if the city fails to meet its material quota, it must pay the operator of its recycling facility the recycle value of the material it does not deliver. Consequently, if the city were to prohibit aluminum cans, it would have to pay hundreds of thousands of dollars in penalty costs! (Seldman, 1976)

High technology resource recovery systems are not only expensive, but unproven technologically, economically and environmentally. They require taxpayers to shoulder the economic risk and are dependent upon retaining the present rate of waste generation. In conclusion, it would appear that mechanical and energy recovery systems are not a feasible waste handling method for most if not all locations in Montana.

6.1.6 Source Separation

The other option which has the potential of recovering a much higher percentage of recyclable materials than resource recovery is source separation. The basic premise of source separation is that wastes should never be mixed if recovery of materials is the goal. Once they are mixed, recycling becomes more expensive and more energy-intensive. Source separation allows for the most resource recovery with the least energy use.

6.1.6.1 Argument against source separation

Source separation is too time-consuming and difficult for the consumer. Therefore, people will not participate. In a recent study, however, (EPA SW-500-1976) this was found not to be true.

Fifteen families kept detailed records of all factors involved in separating glass, cans and newspapers for a period of six weeks. "Expenses (twine for bundling, water for washing, etc.) amounted to 2¢ per month per family. The average time spent on resource separation was about 15 minutes per week." In a survey on attitudes toward solid waste, 73% of those interviewed felt that separation would be easy for them to carry out (EPA SW-500-1976).

Since the separation is done by individuals in their own homes, the success of the program is dependent upon the number of people who participate. Source separation is often dismissed with the statement that "People won't recycle." However, the tremendous capital cost associated with resource recovery systems, coupled with the economic risks which are involved, are making the trade-offs between convenience and high taxes much less appealing.

A study done on source separation examined the percent of participation in terms of other variables. A strong correlation emerged between percent participation and time the program had been in operation (See Figure 6.1). Although the mandatory participation is higher than the voluntary participation, all tend to increase steadily with time.

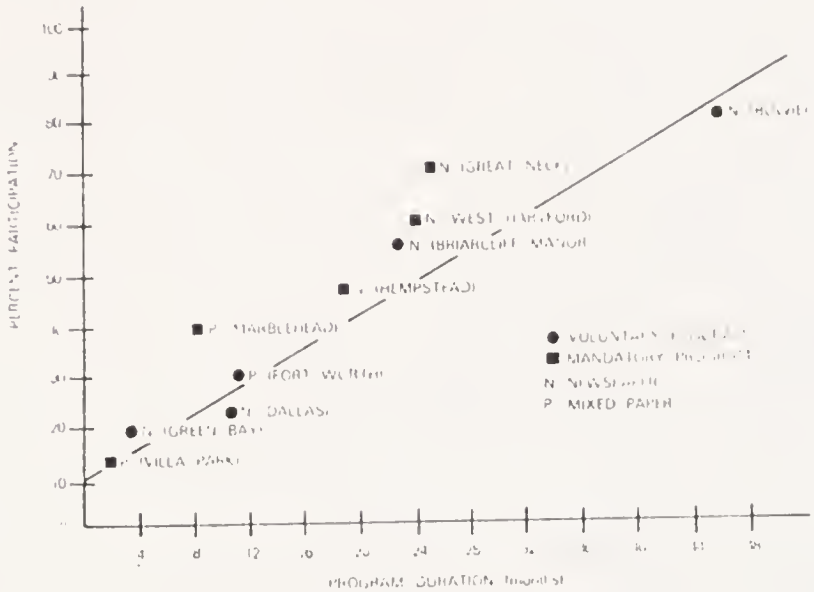
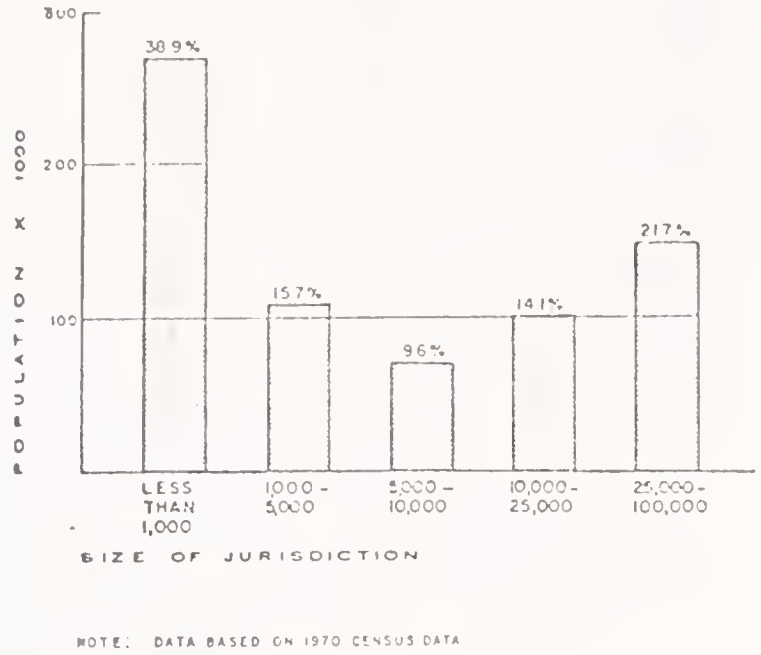


Figure 6.1
Percent Participation in Source
Separation vs. Program Duration

Source: EPA SW-500,1976

6.1.6.2 Economics of Source Separation

One major advantage of source separation over resource recovery is that a workable system can be developed on any scale. This is especially important in Montana where the population is so diffuse (39% of the people in the state reside in towns with populations under 1000 -- See Figure 6.2).



NOTE: DATA BASED ON 1970 CENSUS DATA

Figure 6.2
Distribution of Montana's Population
by Jurisdiction Size

Source: Henningson, 1976

6.1.6.3 Proposal for Rural Source Separation System

In rural Montana areas where the population is too spread out to allow collection, the most common practice is to dispose of wastes on one's own property. This is the simplest and least costly option to rural governments. However, it is difficult to monitor, encourages roadside dumping and incineration, and does not allow for any type of energy or resource recovery.

A bulk container system can be easily adapted for source separation. A sufficient number of containers to serve the rural population are strategically placed along major roads. Each site has appropriately sized containers with individually marked cans for the separate collection of glass, newspapers,

metals, and other mixed wastes. Residents will transport their own separated wastes to the bulk containers. These will be served by collection vehicles which will then transport the wastes from the sites to a centrally located processing plant. Site locations can be chosen so that containers are located on routes to towns, schools, churches, or stores.

Depending on the type of collection vehicle and the size of containers used, various amounts of site preparation will be necessary. A wide space in the road or a natural gravel area would require little more than some grading and additional gravel or blacktop. Costs range from $67 to $200 per site. The costs for sites which require additional work run from $300 to $400 per site.

Some major considerations in using the bulk container system are the initial costs of the containers, the site preparation, and a collection vehicle. There is also the difficulty of determining user charges.

Public acceptance of such a system has generally been high. As the sites are located close to users, changes in population and waste generation can be adapted to by changing the size and location of the containers. (EPA SW-500, 1976)

Employment, once all site preparation is completed, is one driver, part-to full-time, depending on the area served. The driver could be employed by the central processing area and divide the work into collecting and processing.

6.1.6.4 Small Town Source Separation -- The Nottingham Style

A source separation system has been operating successfully in Nottingham, New Hampshire, since January of 1974. When the town dump was prohibited from open burning, the citizens voted to start a recycling center at the old dump site. They passed an ordinance requiring waste separation into metal, glass, clean paper, and all other forms of separation

> Processing the incoming waste into marketable material requires two paid employees working three eight hour days per week. Clean paper and corrugated cardboard, including Kraft paper, is shredded separately and then shipped to a baler. Newspaper is baled . . . at the facility. Glass is color sorted . . . crushed . . . and shipped . . . to a glass recycling factory. Incoming metal is initially sorted by a magnetic separator. Steel and aluminum items are then separately crushed and shipped as fifty cubic foot bins (State of Maine, 1970).

Energy and labor requirements for processing the recycled materials are shown in Table 6.1.8.

Energy Requirements for
Processing Recycled Materials

	GLASS	STEEL	ALUMINUM	NEWSPAPER	CARDBOARD	MIXED PAPER
person hours	2.3	7.0	17.9	4.7	16.2	8.6
kilowatt hours	1.0	18.5	32.4	0.05	28.65	20.10

Source: Tichenor, 1976

> Recycling and Conservation, Inc. of Kittery ME has compiled an analysis of costs and returns for a recycling incineration system in a town of 1200 based on the Nottingham program's first year. Expenses including labor, electricity and fuel for the incinerator amount to $7,280.00. Income derived from the recycled waste reduced the cost to $5,356.00.
>
> An analysis for a town of 5,000 also compiled by R&C, Inc. reveals an annual operating expense of $9,048. This means that operating costs amount to only $1.81 per person -- a significant saving over the $4.46 cost per person living in the community of 1200. (State of Maine, 1976)

Reasonable capital costs for such a system are $65,000.

A study conducted by the Institute of Natural and Environmental Resources of the University of New Hampshire on people's acceptance of the Nottingham programs found 74.8% in favor, 6.3% indifferent, 16.1 opposed, and 2.8% undecided. Non-compliance was minimal, as witnessed by the small number of bottles and cans which showed up in incinerators. (Tichenor, 1976)

6.1.6.5. A comprehensive urban system -- The ORE Plan

For larger cities, Dr. R. Duncan of Portland State University has developed a comprehensive resource recovery system based on source separation called the ORE Plan. It is a self-supporting system which collects both recyclable and mixed wastes. It replaces the present disposal system with a low cost, employment intensive, energy efficient operation. The main source of income would be collection fees supplemented with income from the sale of materials and from other services provided to the community.

The city is divided into Neighborhood Recycling Units (NRU), and Community Recycling Units (CRU). Each NRU has its own recycling center. The size of the area serviced allows the use of small hand or pedal trucks, electric motor vehicles, or small engine pickup trucks, as opposed to the present disposal trucks which are large and costly to operate.

The wastes, once collected, are stored at the recycling center until they are collected by the Community Recycling Unit's trucks for transportation to the secondary materials market. Organics are composted and the remaining waste is landfilled. The CRU's income is supplemented by hauling, scrapping, and providing services to commercial and industrial organizations.

A report for the Portland Metropolitan Service District compared the total system net energy to nine hypothetical total refuse collection systems. (Net energy is the sum of the energy outputs of a system minus the energy inputs.) It was found that the total ORE Plan had the highest net energy generation -- 50% higher than a pyrolysis system which is considered the most energy efficient high technology alternative. User separation and delivery combined with truck pickup of the remaining waste for incineration and landfill (the existing system) shows the largest net loss of energy. The ORE Plan, by utilizing a low energy pickup system, is able to efficiently collect separated and unseparated garbage. All wastes must be accepted, but separation of recyclables should either be encouraged by lowering collection fees or mandated by municipal ordinance.

6.1.7 Waste Reduction

The discussion has so far dealt with methods of handling the waste stream as it now exists. It is true that a great deal of materials and energy can be recovered from the waste stream; however, it is misleading to feel that we are getting something for nothing. It would make more sense, energetically, to reduce the waste stream than to expend energy for recovery. This reduction would result in cost and energy savings associated with waste disposal. It would also reduce the raw materials consumption, the environmental damage associated with extraction, and the energy requirements for manufacturing the items that end up in the waste stream.

Packaging is a prime example of an unnecesary increase in waste production. Packaging in the form of bottles, boxes, cans, cartons and wrapping are by weight the largest portion of the solid waste stream. The consumption of materials for packaging increased 71% between 1958 and 1971. Almost 50% of all paper production, 75% of all glass production, more than 8% of all steel, 14% of aluminum, and 21% of all plastics were used for packaging or containers in 1974 in the U.S. In 1975, 5% (1,770 $x10^{12}$ BTU's) of all U.S. industrial energy went into producing the material for packaging. This does not take into account the energy needed to fabricate, transport, and eventually dispose of the packages (League of Women Voters, 1975).

The cost of all types of packaging as a percentage of product costs has doubled since 1958. Despite the fact that the number of packages rose 32% between 1967 and 1972, the number of jobs in the packaging industry on the other hand has increased 30%. Consumers must pay the cost of producing the packaging as well as the cost of disposing it. The decrease in employment in the packaging industry despite overall industry growth is due, in large extent, to industrial consolidation and centralization of production. Brewers are a good example of such consolidation. In the U. S. between 1940 and 1973, the number of independent brewers dropped from 600 to 100 while consumption remained constant. Breweries in Montana have been reduced to zero.

A new contribution to the waste stream has come from the recent appearance of disposal goods. Items such as disposable diapers, pens, cigarette lighters, etc. have all begun to be used in place of more durable goods. These items, however, are not priced at their true cost as the costs of disposal and litter control are born by the entire population and not just the individual consumers.

Durable goods also enter the waste stream if they are damaged, are too expensive to repair, or have been replaced by newer models. Many of these items can be repaired or contain valuable scrap that can be recovered. The overall number which must be disposed of can be reduced by extending the lifetime of the product or increasing its repairability.

Some states are attempting to reduce the volume of waste. Product reuse has been especially successful to date.

6.1.7.1 "Bottle Bills"

Vermont, Oregon, and South Dakota now have "bottle bills" which require that a deposit be paid on all beer and soft drink containers. In Oregon, reuseable containers are encouraged by requiring only a two-cent deposit on reusables. Soft drinks have a 96% return rate and the 11 oz. beer bottle a 93% return rate. One of the results of this has been a 20% decrease in roadside litter, which is equal to a 75-85% decrease in beverage container litter.

A report by Applied Decisions Systems, Inc. said that 80% of all persons polled stated that Oregon's "bottle bill" had not inconvenienced them or was worth the inconvenience (League of Women Voters, 1975).

The EPA assessed and compared the environmental impact of five different containers for delivering 1000 gallons of beverages (see Table 6.1.9). The fifteen-trip returnable bottle had the lowest energy use, water use, and air emissions.

Table 6.1.9
Environmental Impacts of
Five Beverage Containers

Environmental Impact	15-trip Returnable Glass	All Steel	Bi-metallic Can	One-way Glass	Aluminum Can
Energy (10^6 Btu's)	15	35	54	63	89
Virgin Raw aterials (lbs.)	920	1,800	1,700	7,700	580
Water Volume (000 gallons)	10	34	34	28	17
Waterborne Wastes (lbs.)	47	210	550	120	1,300
Atmospheric Emissions (lbs.)	70	130	220	260	360
Post-Consumer Solid Wastes (cubic feet)	3	3	3	30	3
Industrial Solid Waste (lbs.)	420	4,900	4,600	2,500	1,500

Source: Preliminary data prepared by the Midwest Research Institute for the U. S. Environmental Protection Agency.

Despite a large effort on the part of the container industry, a recent poll conducted by Opinion Research Corp. for the Federal Energy Corp. for the Federal Energy Administration found that 73% of the people in the U. S. favor a law requiring all soft drinks and beer to be sold in returnable bottles and cans.

6.1.7.2 Milwaukee

A grocery store chain in Milwaukee has extended the re-use system even further. The Red Owl Stores "Bring 'em back repack and save" program encourages customers to re-use shopping bags and egg cartons and to purchase milk and soft drinks and beer in returnable bottles. Not only is the system environmentally sound, but also economically beneficial to the consumers. The voluntary program allows customers to take advantage of the returnable and re-usables if they wish, or they can consume the standardly packaged products.

Customers using the program definitely favor it. Store managers were cautious, but almost all felt that the program will become successful with more advertising, more in-store presentation, and more customer learning time. The program has also received a great deal of favorable press. Television station staff, newspaper reporters, and editorial writers were excited by the program and considered it newsworthy and timely.

6.1.7.3 Minnesota

In 1973, Minnesota developed a pioneering package review legislation which called for the Minnesota Pollution Control Agency to review new and revised packages or containers sold in Minnesota.

> MPCA will assess them relative to whether they: 1) minimize the potential for environmental contamination, including but not limited to the release of metals or substances with the potential for biological harm; 2) minimize the total energy cost; 3) minimize the use of scarce or non-renewable resources; 4) minimize the use of virgin materials; 5) are most recyclable where recyclability is consistent with 1) and 2) above; and 6) minimize adverse economic effects on the consumer, the labor force, and industry (Citizens Leagur, 1975).

6.1.7.4 Other Options

Through the establishment of a tax on packaging and disposable goods according to such criteria as the materials consumption and energy intensiveness of their production, product disposability, and its pollution impact, the presence of these items in the waste stream should be reduced. This would allow a more accurate functioning of the free market.

Tires, which represent a major disposal problem due to their near indestructability, could be unit priced so that consumers would be aware of the cost per average mile of different tires. A deposit system could be established so that a worn-out tire could be returned and the deposit

retrieved. This would increase the number of tires available for retreading and reduce the number of abandoned tires.

Durable goods could be redesigned to extend their lifetime, to make them more easily repairable, and less susceptible to stylistic change.

A waste reduction and re-use system results not only in an overall energy savings, but also in savings for local government. This is the only option which would result in lower collection and transportation costs. Disposal problems would also be reduced and litter would be reduced because consumers would be saddled with less packaging to dispose of.

An area with an effective source separation system can easily adapt to reduction in the waste stream. However, such reduction could be an extreme hardship on an energy or resource recovery system which depends on being able to sell the energy and secondary materials which it extracts from solid waste. These systems depend upon a large volume of waste to operate efficiently.

It must be stressed that while source separation may be the best solution to handling our waste disposal problem, it is only an interim solution. Our present high rate of waste generation is unnecessary and unsustainable in the long run. Actions which reduce the waste stream should be given top priority. The danger in establishing a waste recovery system for the purpose of realizing a profit is that you lock the public into its waste generation habits, as you cannot afford waste reduction.

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